a' emd'd.

21. (Once Amended) The method of claim 20, wherein the average energy is calculated by repeatedly moving an energy window by a predetermined timeslice and determining an intermediate average energy within the energy window after each of the movements.

22. (Once Amended) The method of claim 20, wherein the actuator is configured to reduce the maximum allowable current level to a first current level if the average energy reaches the predetermined warning level, the first current level being associated with steady state operation.

23. (Once Amended) The method of claim 20, wherein the maximum allowable current level is increased gradually as a ramp function.

24. (Once Amended) The method of claim 20, wherein the maximum allowable current level is increased as a function of difference between the average energy and the predetermined warning energy level.

REMARKS

Claims 1-24 have been amended and are pending in this application. Applicants respectfully submit that no new matter has been added. Entry and consideration of the foregoing amendments is respectfully requested.

Should the Examiner have any questions or comments concerning the above-identified amendment, please feel free to contact the undersigned at the phone number listed below.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-1283.

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APPENDIX

MARKED-UP VERSION OF THE CLAIMS

1. A method ~~for providing thermal protection for~~comprising:

calculating an average energy in an actuator ~~in~~coupled to a haptic -feedback device~~, the method comprising:determining an average energy in said actuator~~ over a predetermined period of time; and

reducing ~~the~~a maximum allowable current level in ~~said~~the actuator if ~~said~~the average energy ~~is determined to exceed~~exceeds a predetermined warning energy level.

2. ~~A~~The method ~~as recited in~~of claim ~~1~~1, wherein ~~said~~the average energy is ~~determined over time~~calculated by repeatedly moving an energy window by a predetermined timeslice and determining an intermediate average energy within ~~said~~the energy window after each of said movements.

3. ~~A~~The method ~~as recited in~~of claim ~~1~~1, wherein ~~said~~the reducing the maximum allowable current level ~~is reduced~~includes reducing the maximum allowable current level to a ~~sustainable~~first current level if ~~said~~the average energy reaches ~~a maximum energy level allowed by said actuator, wherein said actuator can operate indefinitely without overheating at said sustainable current~~the predetermined warning level, the first current level being associated with steady state operation.

4. ~~A~~The method ~~as recited in~~of claim ~~1~~1, wherein ~~said~~the reducing the maximum allowable current level ~~is reduced~~includes reducing the maximum allowable current level to a first level below a second current level if ~~said~~the average energy reaches ~~a maximum energy level allowed by said actuator, wherein said actuator can operate indefinitely without overheating at said sustainable current~~the predetermined warning level, the second current level being associated with steady state operation.

5. ~~A~~The method ~~as recited in~~of claim ~~1~~1, further comprising raising ~~said~~the maximum allowable current level in ~~said~~the actuator after ~~said~~the maximum allowable current level has been reduced~~,~~ if ~~said~~the average energy is ~~determined to be~~ below ~~said~~the predetermined warning energy level.

6. ~~A~~The method ~~as recited in~~of claim ~~1~~1, wherein ~~said~~the reducing includes reducing the maximum allowable current level ~~is reduced~~ gradually as a ramp function.

7. ~~A~~ The method ~~as recited in~~of claim ~~6~~6, wherein ~~said~~the maximum allowable current level is reduced as a function of the energy by which ~~said~~the predetermined warning energy level has been exceeded.

8. A method as recited in claim ~~1 wherein said average energy is approximated by~~ 1, further comprising:

determining a current in ~~said~~the actuator~~and basing said~~, the average energy ~~proportionally~~being calculated based on ~~said~~the current ~~using a relationship~~ ~~$E = I^2R$~~in the actuator.

9. ~~A~~The method ~~as recited in~~of claim ~~1~~1, wherein ~~said~~the ~~determining~~calculating and ~~said,~~the reducing are performed by a microprocessor local to ~~said haptic feedback device and separate from a host computer communicating with said~~the haptic feedback device.

10. ~~A~~The method ~~as recited in~~of claim ~~1~~1, further comprising sensing current with a positive temperature coefficient (PTC) resettable fuse in a current path of ~~said~~the actuator, ~~wherein said~~the fuse ~~opens~~being configured to ~~stop~~open so that a flow of ~~said~~the current is disrupted when ~~said~~the current increases to a fuse threshold level.

11. ~~A~~The method ~~as recited in~~of claim ~~1~~1, wherein ~~said~~the actuator is a DC motor.

12. ~~A haptic interface device in communication with~~ An apparatus comprising:

a ~~host computer implementing a host application program, said interface device manipulated by. a user, the interface. device comprising:~~

~~a sensor device operative to detect. a manipulation of said interface device by said user, said sensor device outputting sensor signals representative of said manipulation;~~sensor configured to send a signal associated with a movement of a haptic-feedback device;

~~at least one~~an actuator ~~operative~~coupled to the haptic-feedback device and configured to output ~~force to said user~~a haptic-feedback; and

a controller coupled to ~~said~~the actuator and ~~operative~~configured to ~~determine~~calculate an average energy in ~~said~~the actuator over a predetermined period of time ~~as said actuator outputs said forces~~, ~~and~~the controller configured to reduce the maximum allowable current level in ~~said~~the actuator if ~~said~~ average energy ~~is determined to exceed~~exceeds a predetermined warning energy level.

13. ~~A haptic interface device as recited in~~The apparatus of claim ~~12~~12, wherein ~~said~~the controller ~~determines~~is configured to calculate the average energy ~~over time~~ by repeatedly moving an energy window by a predetermined timeslice and ~~determining~~calculating an intermediate average energy within ~~said~~the energy window after each of said movements.

14. ~~A haptic interface, device as recited in~~The apparatus of claim ~~12~~12, wherein ~~said controller reduces said~~the actuator is configured to reduce the maximum allowable current level to a first current level if ~~said~~the average energy reaches ~~a maximum energy level allowed by said method, wherein said actuator can operate indefinitely without overheating at said sustainable current~~the predetermined warning level, the first current level being associated with steady state operation.

15. ~~A haptic interface device as recited in~~The apparatus of claim ~~12~~12, wherein ~~said controller reduces said~~the actuator is configured to reduce the maximum allowable current level to a first level~~.~~ below a second current level if ~~said~~the average energy reaches ~~a maximum energy~~

~~level allowed by said method, wherein said actuator can operate indefinitely without overheating at said sustainable current~~the predetermined warning level, the second current level being associated with steady state operation.

16. ~~A haptic interface device as recited in~~The apparatus of claim ~~12~~12, wherein ~~said~~the controller ~~raises said~~is configured to increase the maximum allowable current level in ~~said~~the actuator after ~~said~~the maximum allowable current level has been reduced~~;~~ if ~~said~~the average energy is ~~determined to be~~ below ~~said~~the predetermined warning energy level.

17. ~~A haptic interface device as recited in~~The apparatus of claim ~~12~~12, wherein ~~said~~the controller is a microprocessor local to ~~said~~the haptic feedback device~~and separate from said host computer~~.

18. ~~A haptic interface device as recited in~~The apparatus of claim ~~12~~12, further comprising a positive temperature coefficient (PTC) resettable fuse ~~provided~~disposed in a current path of ~~said~~the actuator, ~~wherein said~~the fuse ~~opens~~being configured to ~~stop~~open such that a flow of ~~said~~the current is disrupted when ~~said~~the current increases to a fuse threshold level.

19. ~~A haptic interface device as recited in~~The apparatus of claim ~~12~~12, wherein ~~said~~the at least one actuator is at least one DC motor.

20. A method, ~~for providing actuator thermal protection for an actuator in a haptic feedback device, the method~~ comprising:

~~determining~~calculating an average energy in ~~said~~an actuator over a predetermined period of time;

reducing ~~the~~a maximum allowable current level in ~~said~~the actuator if ~~said~~the average energy ~~is determined to exceed~~exceeds a predetermined warning energy level~~,~~; and

~~raising said~~increasing the maximum allowable current level in ~~said~~the actuator if ~~said~~the average energy is ~~determined to be~~ below ~~said~~the predetermined warning energy level, ~~wherein said~~the maximum allowable current level ~~can be raised to~~is not above a ~~maximum possible~~ current ~~that can drive said~~level allowed by the actuator.

21. ~~A~~The method ~~as recited in~~of claim ~~20~~20, wherein ~~said~~the average energy is ~~determined over time~~calculated by repeatedly moving an energy window by a predetermined timeslice and determining an intermediate average energy within ~~said~~the energy window after each of ~~said~~the movements.

22. ~~A~~The method ~~as recited in~~of claim ~~20~~20, wherein ~~said~~the actuator is configured to reduce the maximum allowable current level ~~is reduced~~ to a first current level if ~~said~~the average energy reaches ~~a maximum energy~~the predetermined warning level ~~allowed by said method, wherein said actuator can operate indefinitely without overheating at said sustainable current level~~, the first current level being associated with steady state operation.

23. ~~A~~The method ~~as recited in~~of claim ~~20~~20, wherein ~~said~~the maximum allowable current level is ~~reduced~~increased gradually as a ramp function.

24. ~~A~~The method ~~as recited in~~of claim ~~20~~20, wherein ~~said~~the maximum allowable current level is ~~reduced~~increased as a function of difference between the average energy ~~by which said~~and the predetermined warning energy level ~~has been exceeded~~.

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